

AD-A106 226

FEDERAL AVIATION ADMINISTRATION OKLAHOMA CITY OK CIVI--ETC F/S 1/2
FACTORS RELATED TO THE WELFARE OF ANIMALS DURING TRANSPORT BY C--ETC(U)
MAY 81 6 D HANNEMAN

UNCLASSIFIED

FAA-AM-81-11

NL

1 of 1
Page 226

END
DATE
FILMED
12-81
DTIC

Technical Report Documentation Page

1. Report No. FAA-AM-81-11	2. Government Accession No. AD-A106 226	3. Recipient's Catalog No.	
4. Title and Subtitle FACTORS RELATED TO THE WELFARE OF ANIMALS DURING TRANSPORT BY COMMERCIAL AIRCRAFT		5. Report Date MAY 1981	6. Performing Organization Code
7. Author(s) Gerald D. Hanneman		8. Performing Organization Report No.	
9. Performing Organization Name and Address FAA Civil Aeromedical Institute P.O. Box 25082 Oklahoma City, Oklahoma 73125		10. Work Unit No. (TRAIS)	11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of Aviation Medicine Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591		13. Type of Report and Period Covered	
15. Supplementary Notes This research was conducted under Tasks AM-E-80-VM-1 and AM-B-81-VM-1.		14. Sponsoring Agency Code	
16. Abstract This report contains a brief history of the transportation of animals by air. It describes how various organizations contributed to the safe and humane care of animals during transport and how regulations to insure safer shipping conditions were developed by the United States Department of Agriculture. The two classes of cargo spaces in large aircraft used to transport small animals are discussed in relation to fire safety, environmental considerations and the possible health effects on animals during shipment. Also discussed are problems encountered in the airport terminal holding area, practical considerations in shipping dogs, and examples of animal losses.			
17. Key Words Cargo compartments Animal transportation Animal welfare Aircraft environments Living cargoes		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 14	22. Price

FACTORS RELATED TO THE WELFARE OF ANIMALS DURING
TRANSPORT BY COMMERCIAL AIRCRAFT

Historical Perspective.

Through the early years, commercial aviation devoted its activities to the transportation of mail and people. With growth, the carrying of cargo became more and more important until, at the present time, it represents a significant portion of all air transport operations. The issue to be discussed in this report is the shipping of animals by aircraft. Transport of animals represents only a fraction of the total air transportation industry and, because of this, many issues relative to the welfare of animals during transit have never been adequately addressed. Indeed, instances of animals dying or being permanently harmed in shipment by air are not unusual.

Among the earliest of the live animal cargoes were baby chicks and hatching eggs. In 1929, Pan American World Airways flew hatching eggs from Brownsville, Texas, to Guatemala City, Guatemala, with a 98.5 percent survival. Soon it became apparent to shippers that a newly hatched chick weighs only about half as much as an incubating egg and could be shipped at less cost. They learned further that chicks shipped within 24 hours of hatching could survive up to 72 hours without food and water, thus requiring minimal care (10).

Prior to World War II, the movement of animals by air was limited by the size of the aircraft available in commercial service. There were reports of Canadian carriers transporting horses by strapping them to a pallet and placing the pallet and horse on the floor of the aircraft. The prewar aircraft most frequently used for cargo was the DC-3. Accommodating 21 passengers, this aircraft had only a small forward and aft section for cargo. Near the end of the war, the DC-4 and similar larger aircraft were available for commercial use. The DC-4 had cargo compartments located beneath the passenger cabin. As larger aircraft were being introduced to civil air transport operations, aircraft manufacturers and air transport operators considered the use of an all-cargo aircraft, but such operations did not become economical until later (7).

Prior to World War II, most animals were shipped by ground transportation. The Railway Express Agency (REA)* was the main common carrier and provided adequate space; stowage and special handling; and consistency of feeding, watering, and exercising the animals at regular intervals. Near the end of World War II, the air carriers included the shipment of animals in the air freight service that they offered the general public. Air carriers patterned their care for animals after the REA (7). It was necessary for air carriers to establish shipping charges for their services. Rates varied because of competition. Few carriers filed airfreight rates with the Civil Aeronautics Board (CAB) until 1946. The CAB, with authority to regulate such matters, established rates, charges, rules, and practices for the transport of live animals by the domestic air carriers (7).

*The REA went out of business in the midseventies; however, other freight forwarders carry on the same activities for animals which are still shipped by motor and rail transportation.

How well did animals tolerate shipment by air? By the late forties a considerable number of large animals and zoo-type animals were being so transported. The transportation of small animals and pets, such as dogs, was on the rise. Dogs were becoming more frequently caged and transported in the cargo compartment of the same aircraft carrying their owners. Although dogs appeared to tolerate caging and cargo-compartment shipment fairly well, some breeds that are normally of a more excitable nature displayed considerable nervousness while in flight. It was noticed that most dogs were frequently agitated and excited during takeoff and landing. Because of concern for the welfare of dogs in air travel, the American Society for the Prevention of Cruelty to Animals (ASPCA) asserted that a traveling canine must be provided with a crate in which the animal could stand up and turn around. Some airlines added their own rules for shipping dogs, such as requiring that the dog have a collar, leash, and muzzle. In addition, most states required health certificates, assuring before shipment that a dog was harmless and would require no special attention. They also required that a well-constructed crate be used to prevent the animal from escaping and to prevent collapse of the crate on the animal (10).

The author of the story of the Flying Tiger Airlines, "Hungry Tiger," (5) devoted a chapter to various experiences encountered during the forties and fifties in their cargo carrier's development of means for shipping animals by air. In many cases the greatest problem they had to deal with was the poor packaging of the live animals shipped and their personnel's lack of knowledge in handling the various species.

With experience the air carriers came to a better understanding of animal shipment and, consequently, improved their methods. In some all-cargo aircraft, prefabricated stalls were constructed for large animals, protecting both the animal and the aircraft. Horses were observed to violently throw their heads about. To prevent injury, they were placed in narrow stalls in the aircraft, their heads fitted with padded helmets, and they were haltered and tied sufficiently to restrict excess movement. Cattle were similarly stalled and haltered, but helmets were not used. Smaller animals, such as dogs, were confined to crates that were enclosed on all sides. Ventilation holes were made in crates to avoid suffocation and provide more comfort for the animals (18).

In the late fifties and early sixties, humane groups sought to improve upon the shipping conditions for all animals. Through efforts by the American Humane Association, the National Council on Animal Transportation (NCAT) was organized. NCAT's mission was to develop ways to better the conditions used in shipping live animals by air, land, and sea through efforts and knowledge of private and governmental institutions that had an interest in animal welfare. Many areas for improvement were recognized and recommendations were made to appropriate organizations; however, little in the way of regulatory action came forth until the midsixties.

The Federal Laboratory Animal Welfare Act of 1966 (13) gave the Secretary of Agriculture power to establish humane standards for the treatment of research animals while in transit. In 1970, the Act was amended to include nonlaboratory animals. Unfortunately, neither the Act nor the amendment gave the United States Department of Agriculture (ASDA) authority

to regulate the treatment of live animals during shipment in commerce by common carriers. Further attention was focused on problems related to the safe transportation of animals by air when a subcommittee of the Committee on Government Operations, House of Representatives, held hearings in September of 1973 (17). The purpose of the hearings was to: (i) examine the current regulations governing the containers used in shipping animals and determine whether additional Federal safeguards were needed; (ii) look more closely at the procedures employed by the air carriers in loading and unloading animals for shipment and the treatment that animals received while awaiting shipment and during final delivery to the consignee; and (iii) examine the manner of the routing of animals and what actually happens to them during flight. The hearings pointed out that current airline regulations permit animals to be considered only as freight and, as such, they generally receive no special or priority treatment over other types of cargo.

Three Government agencies have been given the task and legal authority to provide for the safe and humane treatment of animals during the transportation process. These agencies are: the Federal Aviation Administration (FAA), the USDA, and the CAB. The FAA has the responsibility to provide for the safety of the animals once they enter the aircraft; the USDA provides for the animals' safety from the time they arrive for shipment at a scheduled airline and throughout the transport process until received by the claimant; and the CAB rules on rates and other economic aspects of transporting the animals by air.

In 1976, the Laboratory Animal Welfare Act was again amended (14) to provide for the regulation of transportation, housing, care, handling, and treatment of animals by carriers. The Act applies to persons engaged in any business in which an animal is in their custody in connection with its transportation in commerce. By means of this Act the Secretary of Agriculture provides standards to govern the handling, care, and treatment of animals during their transportation in commerce by intermediate handlers, air carriers, or other carriers of animals so consigned.

Through regulation and competition the transportation of animals by air has become more complex and the monetary stakes are considerably higher. At the same time, research and technology have not kept pace with this growing industry. To address issues that arise, concerned industrial leaders, bankers, insurance companies, government officials, and humane associations formed, in 1976, the Animal Air Transportation Association (AATA).

The AATA serves as a clearinghouse for collecting information and ideas related to the transport of animals, makes research needs known to industry and government, and acts as a vehicle for disseminating research findings to interested parties so that action can be taken to improve on methods related to the care and transport of animals by air. Since most of its members became involved in the AATA, the National Council on Animal Transportation was dissolved.

DTIC
ELECTE
S **OCT 27 1981** **D**
B

Unannounced Justification		<input checked="checked" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
By _____		
Distribution/ _____		
Availability Codes		
Dist	Avail and/or Special	
A		

Stowage of Animals During Flight.

Because large animals are normally shipped in all-cargo aircraft, and the monetary value of this type cargo has been high, air carriers have progressively made more of an effort to provide good airfreight service and have been quick to make improvements to insure the safety of their cargoes. Small animal cargoes, on the other hand, being of less economic value and variable in numbers per shipment, have received less consideration in regard to safety in shipment.

Proper stowage of an animal aboard an aircraft is an important part of providing for its care. For this discussion, information on stowage of animals will be confined to small animal concerns, using the dog as an illustration. Small pets or guide dogs for the blind may be allowed in the passenger compartments of commercial air carrier aircraft, depending on the rules of the airline. However, for the most part, dogs and other small animals are carried in crates and stowed in cargo compartments located below the passenger cabin. There are two classes of cargo spaces used for the transport of animals. They are designated as C and D compartments, primarily on the basis of the means for preventing the spread of fire, smoke, and noxious gases from the area. Class C compartments are found only in the larger, wide-bodied aircraft. Wide-bodied aircraft also have D compartments. All other jet and turboprop aircraft have D compartments only.

In both type compartments the environment is constrained by considerations in regard to fire safety. Both compartments are lined with a fire-resistant material. This, however, is their only major similarity. The class C cargo compartments are not readily accessible to the crew in flight. A smoke or fire-detector system is present to give early warning to the pilot or flight engineer of a fire, smoke, or noxious gas problem. The C compartment has a built-in fire-extinguishing system, controllable by the pilot or flight engineer. An extinguishing agent can be released in the compartment in sufficient concentration to extinguish any fire that might occur. Because of these considerations, ventilation in the compartment in flight must at all times be kept at a value low enough to exclude hazardous quantities of smoke, flames, or extinguishing agents from entering any compartment occupied by the crew or passengers.

The class D compartment is not accessible to the crew in flight. There is no fire-extinguishing agent in this compartment. Ventilation and drafts are controlled to such an extent that if a fire were to occur it would not progress beyond safe limits. Thus, control of ventilation is the only means to exclude hazardous quantities of smoke, flames, or noxious gases from entering areas occupied by the crew or passengers.

Environment of Cargo Compartments.

Ventilation for large compartments is limited to 2,000 cubic feet per hour minus the volume of the cargo. For smaller compartments, of 500 cubic feet or less, the ventilation rate allowed is 1,500 cubic feet per hour and this air turnover is primarily due to leakage around the cargo door. The ventilation system for the class C compartment may or may not be in operation when the aircraft is on the ground. There is usually no active cooling

when the system is in operation. Thus, the compartment, even when the aircraft is on the ground, may have restricted ventilation and there may be a significant increase in compartment air temperature, especially during hot weather. Rarely is there positive ventilation in the class D compartment while the aircraft is on the ground (8). Also, there is no positive ventilation to the compartment even when the aircraft is pressurized, except for leakage around the cargo door seal. The bulk of all small-animal shipments is carried in the class D compartment, yet it is the most restrictive of the two classes in terms of providing a healthy traveling environment for the animals.

The cargo compartments are designed to be pressurized by leakage of air into them from other compartments that have positive pressurization. Only when the aircraft becomes pressurized is there air leakage into the cargo compartment from other compartments of the aircraft. There is some loss of pressurization by leakage of air around the cargo door. This creates the airflow in the compartment. When an aircraft is pressurized and the flight initiated, the airflow in the cargo compartments increases until it reaches a maximum at flight altitude. Thus, the air turnover in the compartments is related to the altitude and the length of time at altitude. Of course, the ventilation rate decreases as the aircraft descends.

Because the cargo compartment is so nearly airtight, the air is relatively motionless or stagnant. The available free air, e.g., that which is readily available to an animal, is limited by the quantity and location of the inanimate cargo plus the number, type, and location of other animals being shipped (9). Because of low ventilation and barriers to air circulation caused by the cargo, it is doubtful that a uniform mixing of air occurs. Therefore, in terms of providing for a healthy environment for animals in air transport, it is important to realize that the free air volume of the compartment is of little significance if it is not directly available to and circulated around the animals.

An important environmental consideration in relation to the cargo compartments and well-being of animals is the ambient air temperature. Aircraft manufacturers report that the air temperature in the cargo compartments can range from 35° to 100°F. However, a freight manual (3) reports that it can range from near freezing to 130°F, depending on the season of the year. The compartment ambient temperature can also be affected by temperature of the nonanimal cargo. If the nonanimal cargo were to remain on a hot ramp area for an extended period of time, it would absorb heat, which would irradiate to the animal cargo when animal and nonanimal cargoes are placed inside the compartment. Such heat could be intensified if there is a delay in takeoff, especially during the hot summer months.

Heat has been incriminated more often than any other environmental factor in causing harm and death to dogs and other animals. When the air temperature rises above the animal's normal body temperature, the body temperature rises and the animal must eliminate this increased heat load or a condition termed hyperthermia will ensue. In dogs, for example, as the body temperature approaches 108°F, the dog's heat-regulating mechanism, primarily evaporation of moisture through panting, becomes overtaxed and often the body can no longer dissipate the acquired heat load. When this occurs, the body temperature will continue to rise until the animal dies. The effectiveness of heat dissipation, that is, the ability to cool

the body by evaporating water from the upper respiratory tract, is influenced by the humidity or amount of moisture in the air. When the humidity is high the evaporative heat loss is decreased because of the reduced vapor-pressure gradient. As a result, the length of time a dog can compensate for an increase in body heat load is reduced. Thus, a dog shipped on a hot humid day and confined in a near-tight compartment with added heat load from nonanimal cargo will be subjected to a heat stress beyond its ability to maintain normal body temperature by panting. The result may be death by heat exhaustion.

Carbon dioxide (CO_2) in a tight compartment may be an environmental threat to animals. The volume of cargo, the cargo barriers, and crowding of the cargo around animal shipping crates can reduce the free air volume and seriously impede ventilation to the crate, causing the CO_2 level to possibly rise above safe levels (for dogs) of 5 percent (12). Parameters that influence the CO_2 level in the cargo compartment include: (i) species of animals, (ii) ambient temperature, (iii) humidity, (iv) ventilation, (v) free air volume, (vi) respiratory exchange of the animals (CO_2 , O_2 , H_2O , heat), (vii) transport crate construction, and (viii) location of the crate in the cargo compartment. The density of CO_2 is greater than that of air, so it is possible that harmful levels of CO_2 could accumulate in the lower portions of the dog crate if it were placed near the floor of the compartment. It has been suggested that without adequate air circulation a layer of CO_2 could form in the lower regions of the cargo compartment faster than it could leak out through the door seals and jamb drains (15). It is more probable that a harmful level of CO_2 could be reached before critically low levels of oxygen (O_2) are reached.

Other environmental aspects of the cargo compartment which should be given some consideration are pressurization, noise levels, and light. As noted previously, when the passenger cabin is pressurized, the cargo compartment becomes pressurized as air seeps into it. Pressurization of the aircraft is normally performed just before takeoff. Animals, like humans, are subject to altitude changes that may range up to 7,000 feet in a flight. The noise level of the cargo compartment, as reported by the manufacturers, ranges between 87 and 105 decibels (dB), although higher noise levels are reached as the aircraft is either taking off or landing. During flight, however, less engine noise is transmitted to the cabin and cargo areas. An exception to this would be to the rear of those aircraft which have wing-mounted jet engines. In aircraft with engines mounted on the aft portion of the fuselage, the engine noise transmission to those areas forward of the engines is reduced. Noise levels of 120 to 140 dB are experienced around engines with 10,000 to 12,000 lb thrust operating at full power. Some engines are capable of producing 25,000 to 30,000 lb thrust and produce noise levels in excess of 160 dB (16). The effect of such noise on animal cargoes is relatively unknown.

The cargo compartment is normally unlighted once the cargo door is closed, and light is available only when the door is open. There are some aircraft, however, equipped with lighting that could be left on at the discretion of the shipper or crew.

Environmental conditions in the cargo compartments vary with the type of aircraft. The manufacturers' technical data on class D cargo compartments are assembled in Table I.

TABLE I. General Environment Profile of Class D Bulk Cargo Compartment

	<u>B-737</u>	<u>B-727</u>	<u>B-707/720</u>	<u>B-747</u>	<u>DC-9</u>	<u>DC-10</u>	<u>L-1011</u>	<u>DC-8</u>
Air changes	1/h max.	1/h max.	1/h max.	1-5/h	1.7/h	0.45/h	0.05/h	0.5-1.6/h
Air source	Main cabin exhaust	Main cabin exhaust	Main cabin exhaust	Engine compressors	Main cabin exhaust	Main cabin exhaust	Main cabin exhaust	Main cabin exhaust
Air control	None	None	None	None	None	None	None	None
Temperature control*	None	None	None	None	None	None	None	None
In-flight temperature	40°-100°F	35°-100°F	40°-100°F	40°-65°F	40°-60°F	55°-70°F	60°-75°F	38°-65°F
Sound dB	104 dB	87 dB	93-105dB	--	--	--	--	--
Light in flight	None	None	None	None	None	None	None	None

*Compartment may be heated, but temperature not regulated.

The Airport Terminal Holding Area.

Airlines have holding areas for animals in either the freight service area or the passenger baggage section of the main terminal. The animals remain in one of these areas until loaded onto the aircraft. Most airlines request that dogs being shipped by airfreight arrive at the terminal at least 4 hours before scheduled departure time. Dogs generally remain in the terminal area until they are placed aboard the aircraft. If transferred to other aircraft during the shipment and there are delays, they should be kept in a terminal area. During the time dogs are in the terminal holding area the airlines must abide by the regulations set forth by the Animal Welfare Act, which specifies that the air temperature surrounding a live dog in the terminal holding area shall not at any time exceed 85°F or fall below 45°F. Also, the dogs shall not be exposed to an air temperature in the holding area in excess of 75°F for more than 4 hours at any time. If the air temperature does reach 75°F or higher, additional ventilation must be supplied to the holding area by the use of air-conditioning, windows, doors, exhaust fans and vents, circulating air fans or blowers. Of course, the air being supplied to the area must be fresh. When being transported from the holding area to the aircraft, and vice versa, dogs must also be protected from snow, rain, and direct sunlight if the sun's rays seem likely to cause overheating. When the outdoor air temperature falls below 50°F the transporting device must be covered to protect the animals. The one exception to the 45°F limit is when the animal being shipped is accompanied by a certified statement from the owner of the animal and signed by a USDA accredited veterinarian indicating that it has become acclimated to air temperatures below 45°F (6). This same rule applies to dogs which accompany their owner on a flight and the dogs are handled as excess baggage.

Practical Considerations In Shipping Dogs.

Dogs may be shipped by airfreight or as excess baggage. When shipped by airfreight, the owner, shipper, or intermediate handler brings the dog directly to the freight service area of the airline. If possible, the dog should be shipped by the most direct and quickest route, such as a nonstop flight. In many cases this is not possible because of schedules, airline franchises, points of origin, and destination. The next best arrangement would involve a direct flight where stops are made but the dog does not have to be transferred from one aircraft to another. However, these choices are not always available, especially in travel between a small town and a large city. Occasionally, when multiple numbers of dogs are shipped with more than one crate involved, the entire shipment may leave on the same flight, but the shipment may be split up and arrive at the destination on different flights. When this occurs it is usually because an airline needed the space being occupied by the dogs for other types of cargo. Thus, the dogs may be "bumped" and placed on the next available flight.

A better way to insure that the shipment stays as a group and travels by the most direct schedule without interruptions is to consign the shipment as "air express service." This service may cost about 30 percent more than regular airfreight service.

When a person is traveling by air, and wishes to take his or her dog, it would be advisable to ship the dog as excess baggage. The dog will more likely arrive at the destination at the same time as its owner. The owner may also derive a feeling of comfort just knowing that the dog is in the same aircraft. This method is convenient for the passenger in that the dog can be retrieved in the baggage claim area rather than later from the freight service area. This manner of travel goes well as long as the passenger schedules the flights with one airline and does not have to make a change. If, however, a change between airlines is necessary, then travel could be bothersome because the traveling owner must reclaim the dog at the baggage claim area of the traveled airline and then personally reenter the dog with the next airline on the flight schedule. An airline will not automatically transfer the dog from its baggage holding area to the holding area or aircraft of another airline. When scheduling travel with a dog, a passenger should be aware of the personal responsibility involved in transferring the dog. The passenger also needs to advise the travel agency or airline scheduling the trip that a certain amount of time will be needed to make the necessary transfer.

Examples Of Animal Losses.

If a dog is harmed or dies during air travel, little is normally said. Records of incidents of animal losses in air transport are not always accessible. Most information comes from personal contacts or reports from humane organizations. The environment to which the dog is exposed during travel has frequently been incriminated as causing the death or harm to the animal's health. In some instances the shipping crate has been at fault, either by its construction or design. The following are recorded examples of complaints of dog losses or harm as a result of the transport environment (17): A puppy, unloaded in Seattle following a 14-hour delay, suffered from dehydration and heat exhaustion; after an air flight a dog was never well again and died within a few months; a group of dogs when picked up following a flight were found to have their crates covered with ice, and the dogs were ill; an autopsy report confirmed that a dog's death was attributed to heat prostration and/or anoxia while on board the aircraft; another report found two animals suffered from lack of oxygen; a group of puppies arrived having convulsions; another puppy was found dead on arrival; an animal was lost at the Boston Airport resulting in a 12-hour delay--the animal arrived in shock; a dog arrived at an airport suffering from heat prostration and was ill for 5 hours; a Great Dane arrived dead following a flight, but the cause was not determined; and flight was delayed with the aircraft on the ground in Chicago during a heat wave, resulting in the suffocation death of a St. Bernard. There are times when numbers of animals are involved, such as when 35 animals were shipped to John F. Kennedy Airport instead of Newark during hot weather, with no water available, resulting in the death of 30 of the 35 animals shipped.

In February of 1978, a shipment of 180 sled dogs (Huskies) was being transported on a Pacific Western Airline Hercules Transport from Thule, Greenland, to an Arctic outpost called "Alert" in Canada's Northwest Territories (4,11). The dogs were contained in a large, three-tiered compartmentalized pallet crate (20 by 10 by 10 ft). They were reported to have been tranquilized. Following about a 4-hour flight, 105 dogs were dead. An airline spokesman indicated that when the aircraft took off the dogs "just went crazy." Death apparently occurred from suffocation and from the dogs fighting each other and battering themselves against the walls of the crate.

Table II shows recent published data on losses and claims for animals shipped by domestic scheduled air carriers within the continental United States. The "actual shipper loss" is defined here as the dollar value placed on each claim by the claimant. The data show that the number of claims paid increased from 1975 to 1976. Damage accounted for about 56 percent of the amount paid and 50 percent of the claims in each year. In 1976, the claims paid for "delays" increased (1,2).

SUMMARY

While trying to be objective toward the animal and in particular the dog air-shipment problem, one can see that there is no question that dogs are occasionally harmed during the transport process. During the history of the use of airplanes to transport live animals there has been concern for their welfare, but little has actually been done to solve the number of problems involved or to assure that humane care is provided to them in transit. Over the years, air carriers appear to have lessened the special interest they once demonstrated in the safe handling of small-animal cargo. Several factors which have apparently contributed to the diminished interest for improving safety conditions for small animals in transit include the cost of providing improvements, the regulations imposed to assure the aircraft's safety in flight, and the tariff structure. One can see from the manufacturer's description (Table I) that the environmental conditions that exist in the aircraft's cargo compartments may constitute an environmental threat to the animal. Part of the restrictive nature of the environmental conditions in cargo compartments is mandated by the Federal Aviation Regulations dealing with the containment of potential fires and other hazards in the compartments. It is mandatory that airlines comply with regulations designed to insure the safety of the aircraft and its human passengers. However, Federal law now requires that the airlines maintain acceptable environments for animal cargoes while they are on the ground outside the aircraft. There are, however, no Federal regulations governing the conditions animals are exposed to once aboard the aircraft except for those regulations that pertain to the aircraft compartments. Little is known about actual in-flight environmental conditions that exist in the cargo compartment of an air carrier. Substantial data are not available to document the particulars on cases, claims, and complaints of harm to small animals resulting from air shipments. Persons often assume that when harm comes to a dog or other animals that it is the fault of the aircraft. However, it has not been established that the

aircraft's cargo compartment environment itself is the only problem area. Consideration must also be given to the procedure of processing animals by airlines before and after a flight. This includes the ground time, which in many instances involves more time than the flight itself. Of increasing importance is the manner in which the animals are packaged for shipment, the air terminal holding area conditions, and the flight line environment through which these animals are moved to the aircraft. At the present time, the foremost concern of animal air transportation is to create an environment while in transit which will not produce undue stress and cause death or illness. Heat stress and inadequate ventilation pose the biggest problems to the dog and other animals. This is pointed out through the regulations in the Animal Welfare Act to protect the dog and certain other animals. Although these regulations attempt to provide the basis for acceptable conditions for transporting animals, there are still questions as to whether the present regulations fulfill the needs. Do the regulations provide for sufficient crate ventilation? Are the present atmospheric temperature requirements for terminal holding areas realistic or should they be raised or lowered? What relationship does the humidity in the atmosphere have on the dog at certain air temperatures, and what percent ventilation is necessary for a dog crate at certain temperatures and humidities? These and other questions need to be answered if aviation is to provide for the safe transporting of animals as it has for humans.

Some of the problems surrounding the air transport of animals are being studied at the FAA Civil Aeromedical Institute. By use of instrumented animal cages profiles of environmental factors such as temperature, humidity, and air flow are being recorded from the time an animal is brought to the terminal until it is claimed at its destination. To determine acceptable environmental conditions and satisfactory cages used for shipment, animals, primarily dogs, are subjected in the laboratory to simulated environmental stress conditions and their physiological responses measured. These studies should shed light on conditions that owners may expect their animals to encounter in shipment and on the animals' responses to these conditions. Such information could be the basis for airlines, regulatory agencies or the public to take action, if action is required, to improve the level of care of animals during air transport.

TABLE II. Annual Summaries For Air Freight Loss and Claim Damage
For Live Animals For The Years 1975 and 1976

<u>Year</u>	<u>Actual Shipper Loss</u>	<u>Total Claims Paid</u>	<u>Shortage and Theft</u>	<u>Damage</u>	<u>Delays</u>
1975 Claims		661	167	331	164
Dollar Value	\$248,662	\$88,715	\$19,115	\$49,356	\$20,235
1976 Claims		787	179	379	229
Dollar Value	\$209,899	\$124,189	\$20,118	\$65,226	\$38,845

REFERENCES

1. Air Freight Loss and Damage Claims, Annual Summaries, 1975 edition. Bureau of Accounts and Statistics, Civil Aeronautics Board, September 1976.
2. Air Freight Loss and Damage, Annual Summaries, 1976 edition. Bureau of Accounts and Statistics, Civil Aeronautics Board, 1977.
3. American Airlines: Freight Service Manual, Freight Edition 4, August 31, 1973.
4. Animal Air Transportation Association, NEWSLETTER, Vol. 1, No. 3, p. 3, 1978.
5. Cameron, F.: Hungry Tiger, McGraw-Hill Book Company, New York, NY, pp. 163-176, 1964.
6. Federal Register: Certain Live Warmblooded Animals Under the Animal Welfare Act: Revision of Transportation Standards, Federal Register, Volume 43, No. 95, 1978; and U.S. Department of Agriculture Revision of Standards for the Transportation and the Handling, Care, and Treatment in Connection Therewith of Dogs, Cats, Rabbits, Hamsters, Guinea Pigs, Nonhuman Primates, and Certain Other Warmblooded Animals, Code of Federal Regulations Amendment 78-75, December 1, 1978.
7. Investigation of Premium Rates for Live Animals and Birds. Docket 21474, United States of America Civil Aeronautics Board, Washington, D.C., pp. 12-15, June 13, 1972.
8. Koegeboehn, Larry P.: Animals and the Aircraft Environment. Proceedings, Animal Air Transportation Association, Inc., 4th International Meeting, Toronto, Ontario, Canada, pp. 14-24, November 6-9, 1978.
9. Koegeboehn, Larry P. and J. E. Dingmon: Report Number MDC J5990, Animal Transportation in the DC-10 Aft Cargo Compartment. Douglas Aircraft Company, McDonnell Douglas Corporation, August 1973.
10. Malkin, R.: Boxcars in the Sky, Import Publications, Inc., New York, NY, pp. 45-53, 1951.
11. Oklahoma City Times, p. 9, February 22, 1978.
12. Ort, G. W.: Environmental Guidelines for Live Animal Transport. Document No. D6-42554, Boeing Commercial Airplane Company, July 31, 1975.
13. Report No. 94-580, 94th Congress, Animal Welfare Act Amendments of 1975, Report of the Senate Committee on Commerce on S. 941. U.S. Government Printing Office, Washington, D.C., 1975.
14. Report No. 94-727, 94th Congress, Animal Welfare Act Amendments of 1976. Conference Report to accompany S. 941. U.S. Government Printing Office, Washington, D.C., 1976.

15. Robins, C. S.: Livestock Loading of Class "D" Cargo Compartments. Document Number D6-2073, Revision B, Boeing Airplane Company, Transport Division, April 15, 1969.
16. Sells, S. B., and C. A. Berry: Human Factors in Jet and Space Travel, The Ronald Press Co., New York, NY, pp. 295-306, 1961.
17. Special Studies Subcommittee, Committee on Governmental Operations, House of Representatives: Problems in Air Shipment of Domestic Animals. U.S. Government Printing Office, Washington, D.C. Hearings held September 26-28, 1973.
18. Tapner, H.: Air Cargo, Cossell and Company, LTD, London, pp. 91-95, 1967.